What is claimed is:

1. A method for generating a compressed and expanded waveform from original waveform data, the method comprising the steps of:

frequency band-dividing the original waveform data to produce a plurality of frequency band-divided waveforms;

receiving position data including a plurality of time points indicating when waveform data is to be read out from the plurality of frequency band-divided waveforms, and position information elements indicating a particular location in the plurality of frequency band-divided waveforms corresponding to each time point;

generating at least one processed waveform from each frequency band-divided waveform according to the position data and at least one compression and expansion format; and

superimposing a plurality of processed waveforms generated from all frequency band-divided waveforms to form the compressed and expanded waveform.

2. A method as recited in claim 1, wherein in accordance with a first compression and expansion format, the step of generating at least one processed waveform from each frequency band-divided waveform further includes the steps of:

receiving a plurality of opening and starting addresses, each opening and starting address designating a starting point of cycles that comprise the frequency band-divided waveform;

receiving a plurality of position information elements, each position information element designating a particular cycle and address of the frequency band-divided waveform corresponding to each time point;

reading out first waveform data from the frequency band-divided waveform of approximately two repeated cycles starting at the opening and starting address associated with the cycle corresponding to every other time point, and waveshaping the first waveform data with an envelope to form a first processed waveform; and

reading out second waveform data from the frequency band-divided waveform of approximately two repeated cycles starting at the opening and starting address associated with the cycle corresponding to every other time point that does not coincide with the reading out of the first waveform data, and waveshaping the second waveform data with the envelope to form a second processed waveform.

3. A method as recited in claim 2, further including the step of repetitively reading out cycles within the first and second waveform data when a first interval between addresses designated by the plurality of position information elements is less than a second interval between addresses in the plurality of opening and starting addresses.

4. A method as recited in claim 2, further including the step of jump reading out cycles within the first and second waveform data when a first interval between addresses designated by the plurality of position information elements is greater than a second interval between addresses in the plurality of opening and starting addresses.

5. A method as recited in claim 1, wherein in accordance with a second compression and expansion format, the step of generating at least one processed waveform from each frequency band-divided waveform further includes the steps of:

receiving a plurality of position information elements, each position information element designating a different address of the frequency band-divided waveform corresponding to each time point;

receiving pitch data indicating a read-out speed of the waveform portions;

reading out successive first waveform portions from the frequency band-divided waveform at the read-out speed at every other time point, each first waveform portion comprising waveform data starting at the address of the position information element corresponding to the time point, the successive first waveform portions comprising first read-out waveform data;

reading out successive second waveform portions from the frequency band-divided waveform at the read-out speed at every other time point that does not coincide with the reading out of successive first waveform portions, each second waveform portion comprising waveform data starting at the address of the position information element corresponding to the time point, the successive second waveform portions comprising second read-out waveform data;

waveshaping the first read-out waveform data with an envelope to form a first processed waveform; and

waveshaping the second read-out waveform data with the envelope to form a second processed waveform.

6. A method as recited in claim 5, further including the step of repetitively reading out first and second waveform portions when each read-out start point associated with each position information element is earlier in time than the time point corresponding to the position information element.

7. A method as recited in claim 5, further including the step of jump reading out first and second waveform portions when each read-out start point associated with each position information element is later in time than the time point corresponding to the position information element.

8. A method as recited in claim 1, wherein in accordance with a third compression and expansion format, the step of generating at least one processed waveform from each frequency band-divided waveform further includes the steps of:

receiving a plurality of mark addresses that designate a starting point at zero-crossings of waveform segments of the frequency band-divided waveform;

receiving a plurality of position information elements indicating a particular waveform segment of the frequency band-divided waveform corresponding to each time point;

receiving pitch data indicating a read-out speed of the waveform portions;

reading out portions of at least one waveform segment at the read-out speed at every time point of the frequency band-divided waveform, the portions of at least one waveform segment comprising waveform data starting at the mark address associated with the waveform segment corresponding to the time point; and

sequencing consecutive portions of at least one waveform segment to generate a processed waveform from the frequency band-divided waveform.

9. A method as recited in claim 8, further including the step of repetitively reading out portions of at least one waveform segment when a first interval between addresses designated by the plurality of position information elements is less than a second interval between addresses in the plurality of mark addresses.

10. A method as recited in claim 8, further including the step of jump reading out portions of at least one waveform segment when a first interval between addresses designated by the plurality of position information elements is greater than a second interval between addresses in the plurality of mark addresses.

11. A method as recited in claim 1, further including the step of compressing or expanding each processed waveform by an identical amount of time.

12. A method as recited in claim 11, the step of frequency band-dividing the original waveform data further including the steps of:

sampling the original waveform data at a sampling frequency F_S; and

dividing the original waveform data into N frequency band-divided waveforms, wherein the Mth frequency band-divided waveform, where M is an integer varying from one to N, is sampled at a sampling frequency equal to F_S divided by $2^{(M-1)}$, and has a frequency band ranging from F_S divided by $2^{(M+1)}$ to F_S divided by $2^{(M)}$.

13. A method as recited in claim 12, the step of superimposing a plurality of processed waveforms comprising the steps of:

filtering at least one of the N processed waveforms generated from the N frequency band-divided waveforms according to the frequency band of the frequency band-divided waveform associated with each processed waveform; and

summing the N processed waveforms to form the compressed and expanded waveforms.

14. A method as recited in claim 13, the step of frequency band-dividing the original waveform data further including the steps of:

dividing the original waveform data into three frequency band-divided waveforms;

generating at least one processed waveform from the first frequency band-divided waveform in accordance with a second compression and expansion format comprising the steps of

receiving a plurality of position information elements, each position information element designating a different address of the frequency band-divided waveform corresponding to each time point,

receiving pitch data indicating a read-out speed of the waveform portions,

reading out successive first waveform portions from the frequency band-divided waveform at the read-out speed at every other time point, each first waveform portion comprising waveform data starting at the address of the position information element corresponding to the time point, the successive first waveform portions comprising first read-out waveform data,

reading out successive second waveform portions from the frequency band-divided waveform at the read-out speed at every other time point that does not coincide with the reading out of successive first waveform portions, each second waveform portion comprising waveform data starting at the address of the position information element corresponding to the time point, the successive second waveform portions comprising second read-out waveform data,

waveshaping the first read-out waveform data with an envelope to form a first processed waveform, and

waveshaping the second read-out waveform data with the envelope to form a second processed waveform; and

generating at least one processed waveform from the second and third frequency band-divided waveforms in accordance with a third compression and expansion format comprising the steps of

receiving a plurality of mark addresses that designate a starting point at zero-crossings of waveform segments of the frequency band-divided waveform,

receiving a plurality of position information elements indicating a particular waveform segment of the frequency band-divided waveform corresponding to each time point,

receiving pitch data indicating a read-out speed of the waveform portions,

reading out portions of at least one waveform segment at the read-out speed at every time point of the frequency band-divided waveform, the portions of at least one waveform segment comprising waveform data starting at the mark address associated with the waveform segment corresponding to the time point, and

sequencing consecutive portions of at least one waveform segment to generate a processed waveform from the frequency band-divided waveform.

15. A method as recited in claim 14, the step of superimposing a plurality of processed waveforms further including the steps of:

sampling and low-pass filtering the processed waveform generated from the third frequency band-divided waveform according to the sampling frequency associated with the second frequency band-divided waveform and frequency band associated with the third frequency band-divided waveform to generate a third intermediate processed waveform;

summing the third intermediate processed waveform with the at least one processed waveform generated from the second frequency band-divided waveform to generate a second intermediate processed waveform;

sampling and low-pass filtering the second intermediate processed waveform according to the sampling frequency associated with the first frequency band-divided waveform and frequency band associated with the second and third frequency band-divided waveforms to generate a first intermediate processed waveform; and

summing the first intermediate processed waveform with the at least one processed waveform generated from the first frequency band-divided waveform to form the compressed and expanded waveform.

16. A method as recited in claim 1, the step of frequency band-dividing the original waveform data further including the steps of:

dividing the original waveform data into a plurality of frequency band-divided waveforms, each frequency band-divided waveform having a plurality of frequency band waveform components.

17. A method as recited in claim 16, the step of superimposing a plurality of processed waveforms comprising the steps of:

multiplying each processed waveform with a level-controllable time window;

filtering at least one of the plurality of processed waveforms generated from the plurality of frequency band-divided waveforms according to a frequency band of the frequency band-divided waveform associated with each processed waveform; and

summing the processed waveforms to form the compressed and expanded waveforms.

18. A method as recited in claim 17, the step of frequency band-dividing the original waveform data further including the steps of:

dividing the original waveform data into three frequency band-divided waveforms;

generating at least one processed waveform from the first and second frequency band-divided waveforms in accordance with a third compression and expansion format comprising the steps of

receiving a plurality of mark addresses that designate a starting point at zero-crossings of waveform segments of the frequency band-divided waveform,

receiving a plurality of position information elements indicating a particular waveform segment of the frequency band-divided waveform corresponding to each time point,

receiving pitch data indicating a read-out speed of the waveform portions,

reading out portions of at least one waveform segment at the read-out speed at every time point of the frequency band-divided waveform, the portions of at least one waveform segment comprising waveform data

starting at the mark address associated with the waveform segment corresponding to the time point, and

sequencing consecutive portions of at least one waveform segment to generate a processed waveform from the frequency band-divided waveform; and

generating at least one processed waveform from the third frequency band-divided waveform in accordance with a first compression and expansion format comprising the steps of

receiving a plurality of opening and starting addresses, each opening and starting address designating a starting point of cycles that comprise the frequency band-divided waveform,

receiving a plurality of position information elements, each position information element designating a particular cycle and address of the frequency band-divided waveform corresponding to each time point,

reading out first waveform data from the frequency band-divided waveform of approximately two repeated cycles starting at the opening and starting address associated with the cycle corresponding to every other time point, and waveshaping the first waveform data with an envelope to form a first processed waveform, and

reading out second waveform data from the frequency band-divided waveform of approximately two repeated cycles starting at the opening and starting address associated with the cycle corresponding to every other time point that does not coincide with the reading out of the first waveform data, and waveshaping the second waveform data with the envelope to form a second processed waveform.

19. A method as recited in claim 18, the step of superimposing a plurality of processed waveforms further including the steps of:

sampling and low-pass filtering the processed waveform generated from the third frequency band-divided waveform according to the sampling frequency associated with the second frequency band-divided waveform and frequency band associated with the third frequency band-divided waveform to generate a third intermediate processed waveform;

summing the third intermediate processed waveform with the at least one processed waveform generated from the second frequency band-divided waveform to generate a second intermediate processed waveform;

sampling and low-pass filtering the second intermediate processed waveform according to the sampling frequency associated with the first frequency band-divided waveform and frequency band associated with the second and third frequency band-divided waveforms to generate a first intermediate processed waveform; and

summing the first intermediate processed waveform with the at least one processed waveform generated from the first frequency band-divided waveform to form the compressed and expanded waveform.

20. A method as recited in claim 19, the step of superimposing a plurality of processed waveforms further including the step of establishing the time windows to produce cross-fading.

21. A method for generating a compressed and expanded waveform from original waveform data, the method comprising the steps of:

receiving position data including a plurality of time points indicating when waveform data is to be read out from the original waveform data, and position information elements indicating a particular location in the original waveform data corresponding to each time point;

generating at least one processed waveform from the original waveform data according to the position data and at least one compression and expansion format; and

superimposing a plurality of processed waveforms generated from the original waveform data to form the compressed and expanded waveform.

22. A system for generating a compressed and expanded waveform from original waveform data, the system comprising:

an input device for receiving position data including a plurality of time points and position information elements; and

a processor including memory programmed for frequency band-dividing the original waveform data to produce a plurality of frequency band-divided waveforms, generating at least one processed waveform from each frequency band-divided waveform according to the position data and at least one compression and expansion format, and superimposing a plurality of processed waveforms generated from all frequency band-divided waveforms to form the compressed and expanded waveform.

23. A waveform compression and expansion apparatus for compressing and expanding a plurality of frequency band-divided waveforms generated from an original waveform, the plurality of frequency band-divided waveforms comprising waveform components of a plurality of frequency bands, the apparatus comprising:

compression and expansion means with which the plurality of frequency band-divided waveforms are apportioned to at least two kinds of compression and expansion formats and each of the plurality of frequency band-divided waveforms are compressed and expanded in a direction of a temporal axis by an identical amount; and

a superimposing means in which, by superimposing the plurality of compressed and expanded frequency band-divided waveforms, an original waveform that has been compressed or expanded in the direction of the temporal axis is formed.

24. An apparatus as recited in claim 23, wherein the compression and expansion means executes compression and expansion processing with a processing period that is as long as the frequency band-divided waveform which possesses the waveform component of a low frequency band in the plurality of frequency band-divided waveforms, and forms compressed and expanded waveforms that correspond to the frequency band-divided waveforms.

25. A waveform compression and expansion apparatus for compressing and expanding a plurality of temporally divided waveforms, comprising:

a processing format specification means in which one compression and expansion processing format from a plurality of mutually different compression and expansion processing formats is specified for each of the plurality of temporally divided waveforms; and

a compression and expansion means in which compression and expansion processing is performed on each temporally divided waveform to compress or

expand the temporally divided waveform in a direction of a temporal axis according to the specified compression and expansion format.

Google Exhibit 1009